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Targeting Short-lived, Fast-acting Climate Forcers: Black Carbon, Methane, and Tropospheric Ozone

Discussions about how best to slow global warming have focused largely on reducing greenhouse gas (GHG) emissions, with the greatest emphasis on CO₂. Very deep cuts in CO₂ emissions are undoubtedly necessary to slow, stop, and reverse global warming. CO₂, however, is extremely long-lived -- once emitted into the atmosphere, CO₂ can remain there for centuries, and its effects may persist even longer. Even if all man-made CO₂ emissions ceased today, the impact on global temperatures would not occur quickly enough to slow the processes driving rapid warming and melting.

There are several short-lived pollutants (SLPs) -- black carbon, methane, and tropospheric ozone -- that collectively have had roughly the same temperature impact on Earth over the past few centuries as has CO₂. Because of the short lifetimes of these pollutants (days, months, or a few years) when compared to CO₂, targeting these emissions offers a supplemental climate mitigation strategy that can occur in parallel with efforts to achieve CO₂ reductions, with the advantage of a much faster temperature response. Taking action to reduce SLPs is critical, because these reductions can keep some of the most sensitive systems intact.

Black Carbon: Black carbon warms the atmosphere in two ways. First, its dark color absorbs heat and raises the temperature of the ambient air. Second, black carbon deposits darken snow and ice surfaces, absorbing heat and accelerating the onset of spring melt, which affects both the Arctic and mountain glaciers. Note that there may also be local cooling effects when so-called 'brown clouds', including black carbon, block incoming solar radiation.

Major sources of black carbon include diesel engines, residential fossil and biofuel burning (heating and cook stoves), burning of crop waste, and some selected industries. In the U.S., diesel engines contribute the majority of these emissions. Strategies are available for reducing domestic black carbon emissions, including installing diesel particulate filters (DPFs) on heavy-duty diesel engines. While EPA's new heavy-duty diesel engine rules eventually will require DPFs on all new engines, full replacement of the current fleet with these new engines will take many decades.

Methane: Methane is already part of the Kyoto "basket" of greenhouse gases, and methane reductions generally qualify as offsets under many of the proposed U.S. climate bills. Potential strategies for cost-effective reduction of methane have already been studied by EPA. EPA currently is implementing a "methane to markets" program which could likely be expanded to realize additional cost-effective methane reductions. EPA has statutory authority to regulate some of these emission sources directly.



Tropospheric Ozone: Though recognized by scientists as a climate warming agent, tropospheric ozone is not currently part of the Kyoto “basket” of gases. In OECD countries, including the U.S., the ozone precursor emissions nitrogen oxides and volatile organic compounds are typically controlled as part of an ozone health risk reduction strategy. For climate warming purposes, the “background” or annual average levels of ozone are more relevant than short-term average or peak concentrations. A climate-based ozone reduction strategy should focus on all precursor emissions and target those that are most effective in reducing background ozone concentrations, including methane and carbon monoxide.

Policy Options

SLPs should be addressed as part of a comprehensive national and international strategy to protect the climate:

Arctic-specific efforts: The Obama Administration should continue to seek opportunities to work with its regulatory counterparts among the nations of the Arctic Council (in addition to the U.S., Canada, Denmark (for Greenland), Iceland, Norway, Sweden, Finland, and Russia) to coordinate efforts to reduce SLPs at the regional level. This effort should emphasize near-term first steps that could be taken under existing regulatory authorities, consider what further steps might be advisable, and should include a specific black carbon component, since black carbon acts as a local, as well as global climate forcer in the Arctic. The Administration should also explore opportunities to work with the EU, through such means as the LRTAP framework, and with China and India.

National regulatory efforts: EPA should immediately assess its current authority to regulate SLPs and consider whether the Agency needs to seek additional authority to address SLPs in a way in order to achieve optimal climate benefits. EPA has authority to regulate many sources of methane today and EPA staff is prepared to act quickly to propose regulations and identify additional needed statutory authority to do so. On the other hand, EPA may lack adequate regulatory authority to address comprehensively other SLPs including black carbon. For example, EPA may not have authority to order installation of DPFs on a significant portion of existing diesel engines beyond rebuilt Class 8 trucks. As an element of this effort, EPA should initiate further study of the potential climate benefits of reducing background (annual) tropospheric ozone average concentrations and identify cost-effective strategies for doing so. Both domestic and international sources should be studied.

Inclusion of SLP reduction opportunities in national climate or other legislation:

Congressional leaders now working on legislation to establish emissions reduction programs have raised the question of whether and how to include SLPs within the structure of such a program. Integrating SLPs in a cap and trade program by allowing their use as offsets, or by providing for the use of allowance revenue to fund SLP regulatory initiatives, would provide a valuable source of funding for SLP reductions, but raises significant potential scientific and policy issues. EPA could assist in clarifying the issues involved in such an effort. Legislative action could also include direct



technology-forcing mandates in addition to eligibility for non-CO₂ measures under cap and trade programs and appropriate public funding for diesel retrofits.

International efforts: The U.S. should explore options to address SLPs on a global basis and should consider how such efforts could be integrated into the U.S. approach to multi-lateral climate discussions. As part of this effort, EPA should identify how to capture as much of the methane reduction potential as possible. A similar effort should be made to evaluate the potential climate benefits and cost-effectiveness of possible strategies to reduce black carbon in less-developed-countries, including replacements of brick kilns, coke ovens and cook stoves, and seasonal restrictions on crop waste and field burning.

Assessments and Studies: EPA should initiate a study of the scientific and regulatory aspects of the SLP issue where uncertainty restricts the ability to act, for example, establishing a carbon dioxide equivalent value for black carbon.